

Session: Kinetic versus Fluid/Hybrid Simulations

Chairs: Andrei Smolyakov (USASK) and Ioannis Mikellides (JPL)

—Introductory Comments—

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Some Critical Questions for this Session

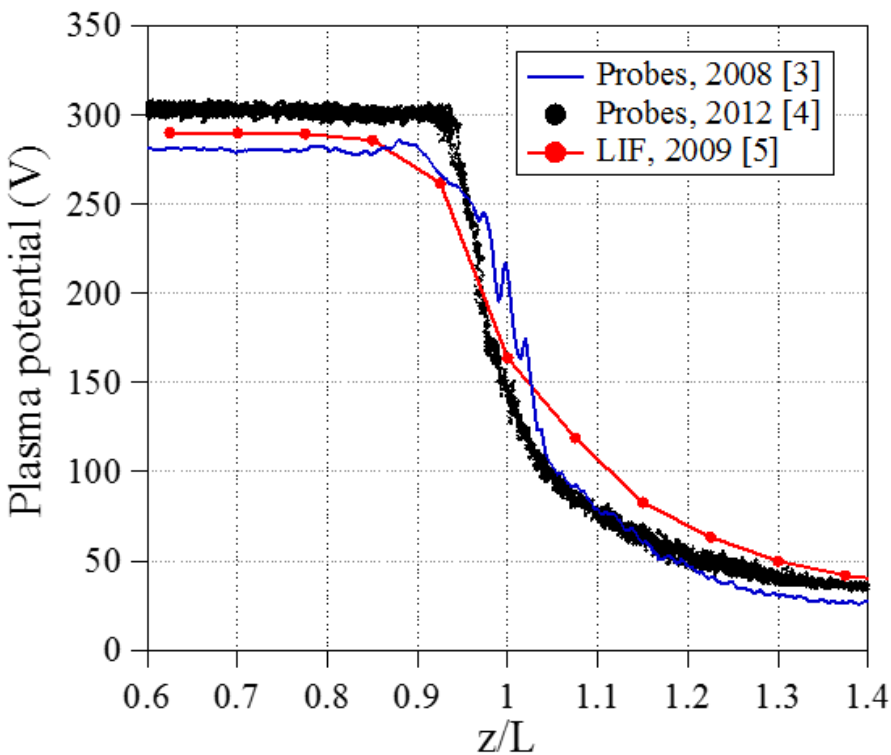
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- **Of the processes in $E \times B$ devices observed in the laboratory, which are amenable to fluid or hybrid methods and which require a purely kinetic approach?**
 - Example: Is the anomalous transport in Hall thrusters really amenable to theoretical formulations involving generalized Ohm's law or is it truly driven by micro-instabilities/turbulence that can be captured only by kinetic methods?
 - Are there processes that can, in principle, be simulated numerically by all approaches? How do the solutions compare and what do such comparisons teach us?
- **Can the theoretical and/or numerical models of such processes be truly validated by experiments?**
 - What experiments in the laboratory would best serve such validation?
 - Are there numerical and/or theoretical challenges, such as extreme sensitivity to physical and/or numerical assumptions and/or computational resource limitations, that are prohibitive of unambiguous validation by experiments?

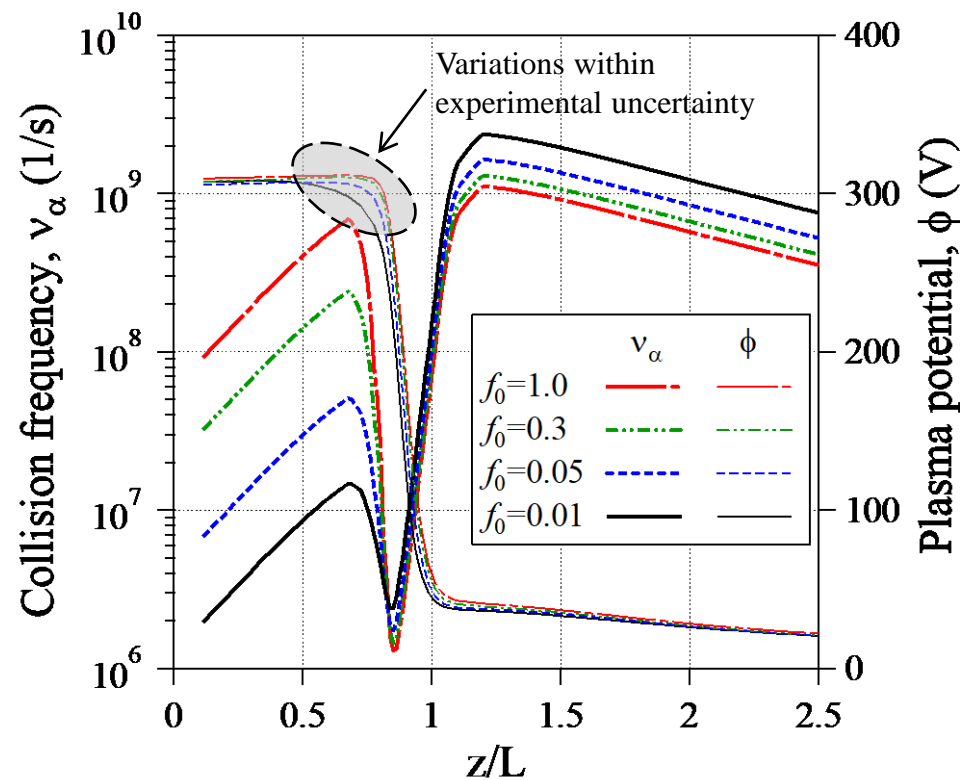
Example: Challenges in the Experimental Validation of Anomalous Transport Models in Hall-effect Thrusters

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Plasma potential measurements obtained in a laboratory Hall thruster by various investigators, at different times, using electrostatic probes or LIF along the channel CL.



Simulations of the same laboratory thruster obtained with the r-z (axisymmetric) fluid code Hall2De [1].



[1] I. G. Mikellides and A. Lopez Ortega, *Plasma Sources Science and Technology*, 2018.

[3] B. M. Reid, and A. D. Gallimore, "AIAA Paper No. 08-5185," 2008.

[4] R. R. Hofer, D. M. Goebel, I. G. Mikellides, and I. Katz, "AIAA Paper No. 12-3788," Atlanta, GA.

[5] W. Huang, B. Drenkow, and A. D. Gallimore, "AIAA Paper No. 09-5355," 2009.